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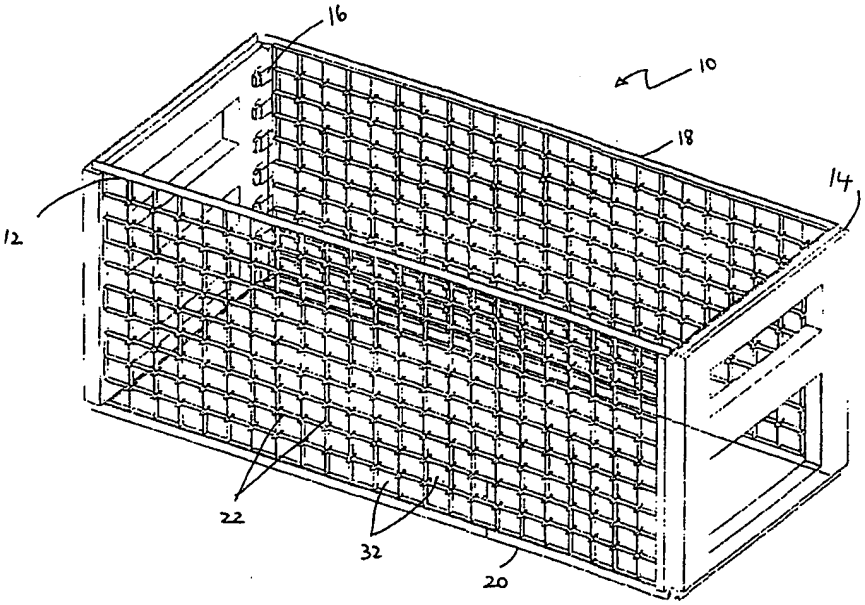

(57) Abstract

A building element (10) comprises a topless and bottomless box constituted of a pair of interlocking L–shaped members (12 and 14). The L–shaped members interlock at diagonally opposite corners (16) and may be filled and secured by a number of means including clay, sand, stone, cement or concrete. The building elements are stackable and include a peripheral channel (18) at the top of the walls, and a peripheral lip (20) at the bottom for receiving the lip (18) of an adjacent stacked building element. The side walls of the element comprise grids or lattice (22). The intersection points of the grid are provided with studs (28) having pointed tips (30) which assist in levering the plaster applied.

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BUILDING ELEMENT

TECHNICAL FIELD OF THE INVENTION

This invention relates to building elements and in particular building elements for low cost housing.

BACKGROUND ART

The growing need to provide large volumes of low cost housing in developing countries has led to the innovation of a number of building elements in the form of hollow blocks or bricks which are stackable and which may be filled and secured by a number of means including clay, sand, stone, cement or concrete, depending on the cost factor or availability of materials.

These innovative building elements generally comprise a plastics material and in some cases, do not even require painting. It has however, come to the Applicant's attention that some persons prefer a plastered finish and this is difficult if not impossible to achieve with known plastic building blocks..

In addition these prior art blocks are inherently flexible or deformable and must be adequately reinforced to prevent bulging or other deformation when the filler material is added. This is particularly true of the lower level blocks when the load bearing is greater.

It is therefore an object of this invention to provide inexpensive, hollow building elements capable of being plastered and which do not suffer the disadvantage of deformation after filling.

THE INVENTION

According to the invention, a building element comprises a topless and bottomless box, at least the longitudinal or side walls of the element comprising a grid or lattice.

In one form of the invention, the gridded walls include on at least some of the intersecting points thereof, a protrusion perpendicular to the gridded walls on at least the external surfaces of the building element.

In this form of the invention, the protrusion may comprise a stud having a pointed tip. The studs may be supported on square columns. These studs provide a levelling surface for the plaster facilitating disguise of the gridded walls beneath the plaster and a smooth finish.

The gridded or latticed walls may define interstices dimensioned to retain the majority of the fill within the building element. This arrangement provides sufficient surface area to which the plaster is able to bond permitting a smooth, plastered finish which may then be painted or otherwise treated to create the desired aesthetic appearance.

Alternatively, the fill may be compacted so that it extrudes through the interstices and therefore does not necessarily require a separate plastering step. The surface can be textured, floated or otherwise treated or fluidized.

In one form of the invention, the bars of the grid include tapered formations protruding perpendicularly from either or both of the walls, preferably on both sides thereof, the formations tapering to a point at a predetermined distance from the centre point of the wall. This double-edged arrangement has the effect of retaining fill material within the building element while rendering the grid invisible beneath the plaster.

In one form of the invention, the end walls of the building elements include one or more buffer or spacer elements. In the preferred form a pair of spaced- apart, hollow, longitudinal buffers are provided. These buffers have a depth dimension equal to the width of the tapered studs of the grid. This facilitates cornering where, at a corner, a building element is stacked lengthways at right angles to the element therebelow. Plastering of the lengthways element takes place as normal, while the end of the element at right angles therebelow is plastered to the level of the buffers.

In one form, cut out formations may be located between the buffers and also in the buffers themselves to not only reduce the material required for manufacture, but also to allow the plaster to bond with the filler material.

Further according to the invention, at least the side walls of the topless, bottomless box may include one or more angled sections.

In this form of the invention, the side or longitudinal walls may include a centrally located, inwardly directed , V-shaped section, the apex of the V being the inwardly directed portion. The angle of the V may be ninety degrees in one form of the invention. In this form, the corners of the box may also be angled, typically at forty five degrees such that the box resembles a pair of octagons joined along two of their shorter sides. In this form the building element comprises fourteen sides.

In one form of the invention, a building element comprises a pair of octagons in abutment with the adjacent abutting walls removed. This may be described as a pair of fused octagons.

In an alternative form, the sides of the octagons are equal in length, permitting the building elements to be stacked either parallel to one another, or perpendicular to one another, or at an angle of forty-five degrees to one another.

In the preferred form, the building elements are provided with formations for interengaging with adjacent elements stacked thereabove or therebelow.

In this form of the invention, the interengaging formations comprise on either the upper or lower edges of the box a channel formation adapted to receive the periphery of one or more adjacent elements in a stacking relationship.

The outer wall of the channel may be continuous and uninterrupted while the inner wall includes one or more castellations or cut outs.

In an alternative form of the invention, both the inner and outer walls of the channel are castellated, the castellations preferably being in register with one another to form short, spaced apart channel sections around the edge of the building element. This reduces the quantity of plastic required to manufacture the elements.

In one form of the invention the castellations located on the corner sides in the outer wall of the channel are shorter than the corresponding castellations on the inner wall. This permits stacking of the building elements.

A similar situation applies at the apex of the central V-shaped section, but in reverse. The outer wall castellations are shortened and there is no juncture of the inner wall castellations either side of a transverse central line. This permits stacking at a forty five degree angle.

In one form of the invention, steel reinforcing may be provided in the vertical angular indentations before plastering.

In use, the angled sections form interruptions in the longitudinal walling to take up expansion and contraction forces. If the building element is manufactured as a sturdy, stackable element not subject to aging, degradation or brittleness, these angled sections serve to reinforce the longitudinal walls and reinforce these walls to prevent bulging.

A further advantage of the vertical indentations which result in a completed wall which is to be plastered, is that the additional thickness of the plaster at these points prevents ingress of water between the abutting end walls of horizontally adjacent building elements

Also in the preferred form of the invention, the topless and bottomless box comprises a pair of interengageable right angled elements. In this form, the interengaging formations preferably comprise tongue and groove formations. It has been found that flexible male elements having hooked free ends engageable in complemental female elements which have formations for receiving the hooked ends, are more suitable.

In one preferred form of the invention a series of male elements may be provided at one end of a right angle portion of a box and complemental female elements at the other end, so that a pair of right angled portions may be joined together by mating the corresponding male and female elements.

The above building elements are preferably injection moulded from a plastics material such as ABS; PVC or POLYPROP or PS. Singularly or in combination.

In a further alternative form of the invention, the grid comprises a mesh, the material of construction of the building element being capable of folding transversely at predetermined points to form a topless, bottomless box.

In one form of this form of the invention, the box comprises a unit or single sheet of material.

In this form of the invention, the walls are stepped near the top and or bottom for engaging the periphery of an adjacent element in stacking relationship, the step at the top and the step at the bottom being oppositely orientated.

Also in this form of the invention, the unit of material comprises a meshed sheet and in particular a sheet of expanded steel may be used. In this form, when fill material (which may be cementitious) is added, the internal area of the building elements may be overfilled such that the excess material is forced out through the apertures. This can then be smoothed and augmented to produce a plaster finish.

In this form the sheet of expanded steel may be foldable to form inwardly directed V-shaped sections at the longitudinal midpoint of the side walls of the box. The angle of the V is preferably ninety degrees as described above. Angled corner sections may also be provided such that when the sheet is folded into the box form, the box resembles a pair of octagons in abutment with their abutting walls removed.

In this form no integral means is provided for securing the free ends of the sheet to each other at the corner of the box. It is anticipated that securing means will not be required as the interengagement of adjacent stacked building elements by means of the peripheral steps at the top and or bottom of the walls should be sufficient to maintain the integrity of the boxes formed. If additional support is required, the ends of the walls may be simply tied with suitable ties which may be metal or plastic.

In an alternative form of the invention, the unit of material comprises a steel sheet which has been progressively expanded in sections. In this form, the expanded sections are interrupted by solid sections defining the end of one sectionalised expansion and the beginning of the next sectionalised expansion. In this form, these solid sections define the angled sections of the building element, and the predetermined folding lines may be formed by means of serating, slotting, grooving or compression along these lines, singularly or a combination of these methods.

Also in this form of the invention, the periphery of the top and bottom of the walls may include castellations or cutouts which define the predetermined folding points, the width of the castellations determining the lengths of sections of the wall, the widths being equal units, or multiples thereof. The sheet may include transverse grooves to facilitate the folding process. Typically, the castellations would be of unit length save for two castellations of twice unit length which form an inwardly directed V-shaped section at the longitudinal midpoint of the side walls of the element. In the preferred form, the angle of the V is ninety degrees as described above, such that when the sheet is folded into the box form, the box resembles a pair of octagons in abutment with their abutting walls removed.

Thus in this form of the invention, the corners of the box comprise a unit length as defined by the width of the castellation at this point.

In this form, cutouts are preferably only provided at the bottoms of the walls. Similarly the stepped formations are also provided only at the bottoms of the walls to ensure that a double overlap does not occur when stacked.

In this form the solid corner sections provide added stability, rigidity, vertical strength and most importantly, good surfaces for the mating or interengaging of the corner interlocks.

Further, lugs or tabs may be provided at one end of the sheet for engaging complimental slots in the other end to provide a positive joining of the to ends to complete the box. The lugs are fed through the slots and then bent over to maintain the two ends together or may simply be pressed into one another.

In a modification of this form of the invention, the bottom ends of the solid sections may be slotted to provide a central tab or flap which may be stepped or dog-legged outwardly, while the tabs either side thereof may be stepped inwardly so that the three tabs straddle the continuous upper edge of the building element below when stacked. This system of interlocking permits a secure interlock and better horizontality for levelling the rows.

In a further alternative form of the invention, flat solid sheets of material may be used to form the box. In this form the walls of the box may also include one or more holes therein and in the preferred form, at least the longitudinal walls include a plurality of apertures. In this form, when an excess of cementitious fill material is added, it is again forced out through the apertures. This can then be smoothed and augmented to produce a plaster finish. The apertures are preferably produced by punching through the sheet with an appropriate tool such that the resulting apertures are surrounded by jagged edges at their peripheries. Some of the apertures may also be formed by punching through in the opposite direction. These jagged edges improve the adherence of the fill material to the building element internally, while on the external side they form a convenient surface for plaster to be applied. The jagged edges should be of sufficient length to permit a layer of plaster to be applied which is sufficiently thick to permit adherence to the remainder of the steel surface. Ideally the flat surface of the steel should be minimised, with only sufficient being left so as to maintain the integrity of the shape of the building element. This is assisted by the angled sections of the element which assist in reducing or preventing bulging under the weight of the filler material.

In this form of the invention, the sheet material preferably comprises steel or the like metal. Ideally sheet steel, coil steel, expanded sheet steel or wire-welded sheet steel are employed. While it is conceivable that a suitable polymeric material could be used which may be formed in appropriately dimensioned sheets, the applicant proposes that the use of a metal and in particular steel is more appropriate. The main reason for this is that concrete adheres well to steel and also that little or no reinforcing will be required if an appropriate grade and thickness of steel is used.

In all of the above forms of the invention, the end walls of the box may further include cutout sections to permit introduction of electrical and other conduits. In the preferred form, the cutouts comprise equally sized apertures separated by a centrally located, diagonally orientated transverse bar. This design has the advantage of providing an entrance or exit point for conduits, as well as reducing the likelihood of moisture creep by means of capillary action.

The longitudinal or side walls may also include large cutouts similar to those in the end walls. These assist in bonding with laterally adjacent building elements for the building of internal walls.

A further advantage of the use of steel is that the sheets may be produced at far greater speeds than corresponding plastic sheets. The sheets may be transported flat or indented which permits greater quantities to be transported at a greater rate.

Furthermore high speed production lines can be commissioned in which coil steel is continuously perforated with alternating slits, stretched, stamped and cut. The building elements may also be made by stamping sheets of expanded metal, or other grid-like sheets of wire-welded material to form grooves and cutouts to facilitate bending into the required shape on site.

In a further alternative form of the invention, a building element comprises a plurality of expanded metal sheets foldable and securable to adjacent sheets to form a topless and bottomless box, the sheets being securable to one another by fasteners.

In this form of the invention, a pair of metal sheets may be provided to form the box, the sheets comprising steel which has been expanded in sections such that the expanded sections are interrupted by solid sections defining the end of one sectionalised expansion and the beginning of the next sectionalised expansion.

As described above, the solid sections may be provided with folding lines formed by means of serating, slotting, grooving or compression along these lines. These folding lines permit formation of angled sections at the midpoints of the longitudinal sides, if required. Similarly slots may be provided in a solid section to permit folding to form an L-shaped element. Two L-shaped elements may then be fastened together to form a box which is then stackable upon other such boxes.

In this form, the solid sections may be provided with suitably located holes facilitating fastening to adjacent L-shaped elements and boxes by means of pop-rivets.

In this form, the sheets may be produced flat and then the angles of the bends may be pressed into the sheets consecutively and automatically prior to transportation to a site for erection.

EMBODIMENT OF THE INVENTION

An embodiment of the invention is described below with reference to the accompanying drawings in which:

Figure 1 is an isometric view of a building element according to the invention;

and

Figure 2 is a similar view of one half of the element of Figure 1;

Figure 2A is a partial front view of a longitudinal side of an element;

Figure 3 is a plan view of an alternative form of a building element according to the invention;

Figures 4 and 5 are isometric views of the element of Figure 3;

Figures 6 and 7 are isometric views of an alternative form of Figure 3;

Figure 8 is an isometric view of a further alternative form of a building element according to the invention;

Figure 9 is a plan view of the element of figure 8;

Figure 10 is an isometric view of a unit of material which comprises the element of figure 8;

Figure 11 and 12 are similar views of partially assembled elements of figure 8;

Figure 13 is a magnified view of the lower end of a wall of the element of figure 8;

Figure 14, 15 and 16 are front and plan views of an alternative form of the invention;

Figure 17, 18 and 19 are similar views of a further alternative but similar form of the invention shown in figures 14 to 16;

Figure 20 is an isometric view of yet a further alternative form of the invention;

Figure 21 is a plan view of a sheet of metal, a pair of which comprise a building element according to the invention;

Figure 22 is an isometric view of the element of figure 21;

Figure 23 is a further isometric view of the preferred form of a building element according to the invention;

and

Figure 24 is a magnified view of the end of a wall of the element of figures 21 to 23.

In Figure 1, a building element 10 comprises a topless and bottomless box constituted of a pair of interlocking L-shaped members 12 and 14. The L-shaped members interlock at diagonally opposite corners 16.

The building elements are stackable and include a peripheral channel 18 at the top of the walls, and a peripheral lip 20 at the bottom for receiving the lip 18 of an adjacent stacked building element.

The side walls of the element comprise grids or lattices 22. The bars of the grid have tapered protrusions 24 extending either side of the walls, which taper to a sharp edge 26. These may be referred to as slats and are illustrated in figure 2A.

The intersecting points of the grid are provided with studs 28 having pointed tips 30 which assist in levelling the plaster applied.

The bars of the grid and the interstices 32 defined by them are dimensioned to provide the plaster with sufficient contact with filler material (not shown) within the building element to facilitate bonding between them. The sharp edges of the bars of the grid on one side assist in maintaining the filler material within the building element without excessive deformation of the side walls, while on the other they ensure that the grid is not visible beneath the plaster.

The bars of the grid define interstices 32 and the dimensions of both are selected to optimize the area of fill material available for bonding with the plaster, when it is applied.

The short end walls of the building elements are provided with a pair of hollow longitudinal buffers 36. Cut outs 38 are provided between the buffers. The buffers have a depth dimension A-A corresponding to the width of the tapered bars or slats 24 of the grids on the side walls to facilitate plastering at corners.

In Figure 3 a building element, which may be presented as a pair of diagonally opposite portions (not shown) and which comprises a shape consisting of fused octagons 10, 12, thus providing right angled V-sections 14 at the centres of the side or longitudinal walls and 45° corner mitres. Interengaging lips 18 and channels 16 are provided top and bottom respectively, the channels 16 shown in the Figure 1 being the top channels but they may be reversed as shown in the remaining drawings. The bottom channels are not visible and they are complemental to the top channels.

A series of slats 24 may be provided to assist in a plastering operation for the outside of the element. The slats are both horizontal and vertical and form a grid or lattice. The slats making up the lattice or grid are the same as those shown in Figure 2A.

In Figure 4 a half element along a diagonal is shown which has formations (not shown) at either free end to interengage to form the element of Figures 3 and 5. In Figures 4 and 5 the detailed channels are not shown.

The short end walls of the building elements are provided with a pair of hollow longitudinal buffers 36. Cut outs 38 are provided between the buffers. The buffers have a depth dimension A-A corresponding to the width of the tapered bars 20 of the grids on the side walls to facilitate plastering at corners.

Turning to Figures 6 and 7 a building element is shown to comprise a pair of fused octagons in which the lengths of the sides of the octagons are all equal.

This arrangement permits parallel stacking, perpendicular stacking as well as stacking at an angle of 45 degrees.

In figures 8 through 13, a stackable building element 10 is illustrated which comprises a sheet of expanded steel which is foldable along various transverse lines 12 to form the topless and bottomless elongated structure. The walls and in particular the longitudinal or side walls of the element include a plurality of holes formed during the process of expanding the steel. These holes permit excess filler material to ooze through the walls of the element 10 and this excess material can then be smoothed to provide a plastered finish.

The bottom edges 14 of the walls are stepped inwardly (see figure 13) to receive the periphery of the upper edges of the building elements stacked therebelow. The upper edges 16 may also be stepped but outwardly.

The sheet is grooved, scored or the like along the fold lines 12 to permit bending of the steel mesh into a structure which resembles a pair of fused octagons (figure 9) in abutment, with the abutting walls 16 removed. The midpoints of the longitudinal sides include inwardly-directed, ninety degree angled sections 18 which may be stamped out prior to folding, or simply folded on site as part of the assembly of the element. These angled sections add rigidity to the longitudinal walls and prevent bulging of the walls as illustrated in the element shown in figures 3 through 7 above.

Once assembled, the free ends 20 and 22 of the expanded steel sheet may be tied together if required, but it is believed that the interengagement with elements stacked thereabove and therebelow will be sufficient to maintain the box-like shape.

The end walls 24 include cutouts 26 separated by a diagonally disposed cross-strip 28, to permit installation of electrical conduits and piping.

In figures 14, 15 and 16, an alternative form of the invention is shown which comprises a unit of progressively, sectionalised expanded steel. The progressive expansion process results in sections of meshed steel 30 separated by solid sections 32. The solid sections are scored or otherwise treated to permit folding. Castellations or cutouts 34 are made in the central portions of the lower edges of the solid sections. The widths of the cutouts are equal and correspond with the positioning of the fold lines 12.

In this form the one free end of the sheet includes lugs or tabs 36 to be fed through corresponding holes 38 in the opposite end. The tabs are bent over to produce a positive joint.

In this form the solid corners and angles provide improved rigidity and a good surface for the mating of the corner interlocks.

In figures 17, 18 and 19 a further alternative form is illustrated which differs from that of figures 14 to 16 only in that the bottom ends of the solid sections are slotted to provide central flaps or tabs 40 and also flaps 42 to either side thereof. The central and side flaps may be bent or dog-legged in opposite directions to enable this section to straddle the continuous periphery of the elements stacked below.

In both of the above forms, the solid sections which make up the V-shaped sections at the midpoints of the side walls should be of a greater width than the other solid sections to ensure that the V is deep enough to provide sufficient reinforcing.

Turning to figure 20, a building element is shown to comprise a foldable sheet of steel or polymeric material in which the plurality of holes 50 have been punched out of a solid sheet rather than being formed during an expansion process. The method of interlocking for stacking remains the same with peripheral step 52 engaging the peripheral step 54 of the elements below in the stack. Although this type of building element is likely to be more sturdy, the manufacturing cost is substantially increased because of the greater metal (or plastic) content and also the need for an additional punching-out procedure.

In figure 21, a sheet of sectionalised expanded steel 10 is shown to comprise solid sections 12 defining expanded sections 14.

The sheets 10 are folded and bent on site to form identical L-shaped elements. Holes 16 in the solid section 12 facilitate pop-rivetting of the L-shaped sections together to form a stable topless and bottomless box (see Figure 22) which is stackable.

The top ends of the walls are stepped 18 near the top for engaging the periphery of the adjacent element to be stacked thereabove.

CLAIMS

1. A building element it comprising a topless, bottomless box, characterised in that at least the longitudinal or side walls thereof comprise a grid or lattice.

2. A building element according to claim 1 characterised in that the gridded walls include on at least some of the intersecting points thereof, a protrusion perpendicular to the gridded walls on at least the external surfaces of the building element.

3. A building element according to claim 2 , characterised in that the protrusion comprises a stud having a pointed tip, the stud being supported on a square column.

4. A building element according to claim 1, characterised in that the gridded walls define interstices dimensioned to retain the majority of the fill material located within the building element.

5. A building element according to claim 1, characterised in that upon compaction of the fill material, it extrudes through the interstices obviating plastering.

6. A building element according to any of the above claims, characterised in that the bars of the grid include tapered formations extending perpendicularly from either or both of the side walls, the formations tapering to a point a predetermined distance from the centre point of the wall.

7. A building element according to claim 6, characterised in that the tapered formations extend both outwardly and inwardly of the element.

8. A building element according to any of the above claims, characterised in that the end walls thereof include one or more buffer or spacer elements having a depth dimension equal to the width of the tapered studs of the gridded side walls.

9. A building element according to claim 8 characterised in that a pair of spaced-apart, hollow, longitudinal buffers are provided.

10. A building element according to claim 9, characterised in that cutout formations are located between the buffers and in the buffers themselves.

11. A building element according to claim 1, characterised in that at least the side walls thereof include one or more angled sections.

12. A building element according to claim 11, characterised in that the side walls thereof include a centrally located, inwardly directed, V-shaped section, the apex of the V being the inwardly directed portion.

13. A building element according to claim 12, characterised in that the angle of the V is ninety degrees.

14. A building element according to claim 13, characterised in that it comprises a pair of octagons in abutment with the adjacent abutting walls removed.

15. A building element according to claim 14, characterised in that the sides of the octagons are equal in length.

16. A building element according to any of the above claims having formations for interengaging with adjacent elements stacked thereabove or therebelow, the interengaging formations comprising on either the upper or lower edges of the box a channel formation adapted to receive the periphery of one or more adjacent elements in a stacking relationship characterised in that both the inner and outer walls of the channel are castellated, the castellations preferably being in register with one another to form short, spaced apart channel sections around the edge of the building element.

17. A building element according to claim 16, characterised in that the castellations located on the corner sides in the outer wall of the channel are shorter than the corresponding castellations on the inner wall.

18. A building element according to claim 16, characterised in that at the apex of the central V-shaped sections, the outer wall castellations are shortened and there is no juncture of the inner wall castellations either side of a transverse central line.

19. A building element according to claim 11, characterised in that steel reinforcing is provided in the vertical angular indentations before plastering.

20. A building element according to any of the above claims, characterised in that it is injection moulded from a plastic material being acrilonitrilebutadienestyrene, polyvinyl chloride, polypropylene or polystyrene, singularly or in combination.

21. A building element according to claim 1, characterised in that the grid comprises a mesh, the material of construction of the building element being capable of folding transversely at predetermined points to form a topless, bottomless box.

22. A building element according to claim 21, characterised in that the box comprises a unit or single sheet of material.

23. A building element according to claim 21, characterised in that the walls are stepped near the top and or bottom for engaging the periphery of an adjacent element in stacking relationship, the step at the top and the step at the bottom being oppositely orientated.

24. A building element according to claim 21, characterised in that the unit of material comprises a meshed sheet and in particular a sheet of expanded steel.

25 A building element according to claim 24, characterised in that the expanded steel is foldable to form inwardly directed V-shaped sections at the longitudinal midpoint of the side walls of the box.

26. A building element according to claim 25, characterised in that the angle of the V is ninety degrees.

27. A building element according to claim 26, characterised in that angled corner sections are provided such that when the sheet is folded into the box form, the box resembles a pair of octagons in abutment with their abutting walls removed.

28. A building element according to claim 27 characterised in that no integral means is provided for securing the free ends of the sheet to each other at the corner of the box.

29. A building element according to claim 22, characterised in that the unit of material comprises a steel sheet which has been progressively expanded in sections.

30. A building element according to claim 29, characterised in that the expanded sections are interrupted by solid sections defining the end of one sectionalised expansion and the beginning of the next sectionalised expansion, the solid sections define the angled sections of the building element.

31. A building element according to claim 30, characterised in that the predetermined folding lines are formed by means of serating, slotting, grooving or compression along these lines, singularly or a combination of these methods.

32. A building element according to claim 31, characterised in that the periphery of the top and bottom of the walls may include castellations or cutouts which define the predetermined folding points, the width of the castellations determining the lengths of sections of the wall, the widths being equal units, or multiples thereof.

33. A building element according to claim 32, chararacterised in that the sheet includes transverse grooves to facilitate the folding process.

34. A building element according to claim 33, characterised in that the castellations are of unit length save for two castellations of twice unit length which form an inwardly directed V-shaped section at the longitudinal midpoint of the side walls of the element.

35. A building element according to claim 34, characterised in that the angle of the V is ninety degrees.

36. A building element according to claim 32, characterised in that cut outs and stepped formations are provided only at the bottom of the walls.

37. A building element according to claim 36, characterised in that lugs or tabs are provided at one end of the sheet for engaging complimental slots in the other end to provide a positive joining of the to ends to complete the box.

38. A building element according to claim 30, characterised in that the bottom ends of the solid sections is slotted to provide a central tab or flap which are stepped or dog-legged outwardly, while the tabs either side thereof may be stepped inwardly so that the three tabs straddle the continuous upper edge of the building element below when stacked.

39. A building element according to claim 22, characterised in that a flat, solid sheet of material is used to form the box, the grid comprises a plurality of apertures punched thereinto in such a manner that the apertures formed are surrounded by jagged edges at the peripheries thereof.

40. A building element according to claim 22, characterised in that the sheet material comprise sheet steel, coil steel, expanded sheet steel or wire-welded sheet steel.

41. A building element according to claim 21, characterised in that it comprises a plurality of expanded metal sheets foldable and securable to adjacent sheets to form a topless and bottomless box, the sheets being securable to one another by fasteners.

42. A building element according to claim 41, characterised in that it comprises a pair of steel sheets expanded in sections such that the expanded sections are interrupted by solid sections defining the end of one sectionalised expansion and the beginning of the next sectionalised expansion, at least one solid section in each sheet including

grooves and/or slots to facilitate folding into an L-shape, a pair of L-shaped elements being fastenable together to form a box stackable upon similarly constructed boxes.

43. A building element according to claim 42 in which the solid sections include holes to facilitate fastening to adjacent elements by means of pop rivets.

44. A building element according to any of the above claims substantially as described in the accompanying drawings.

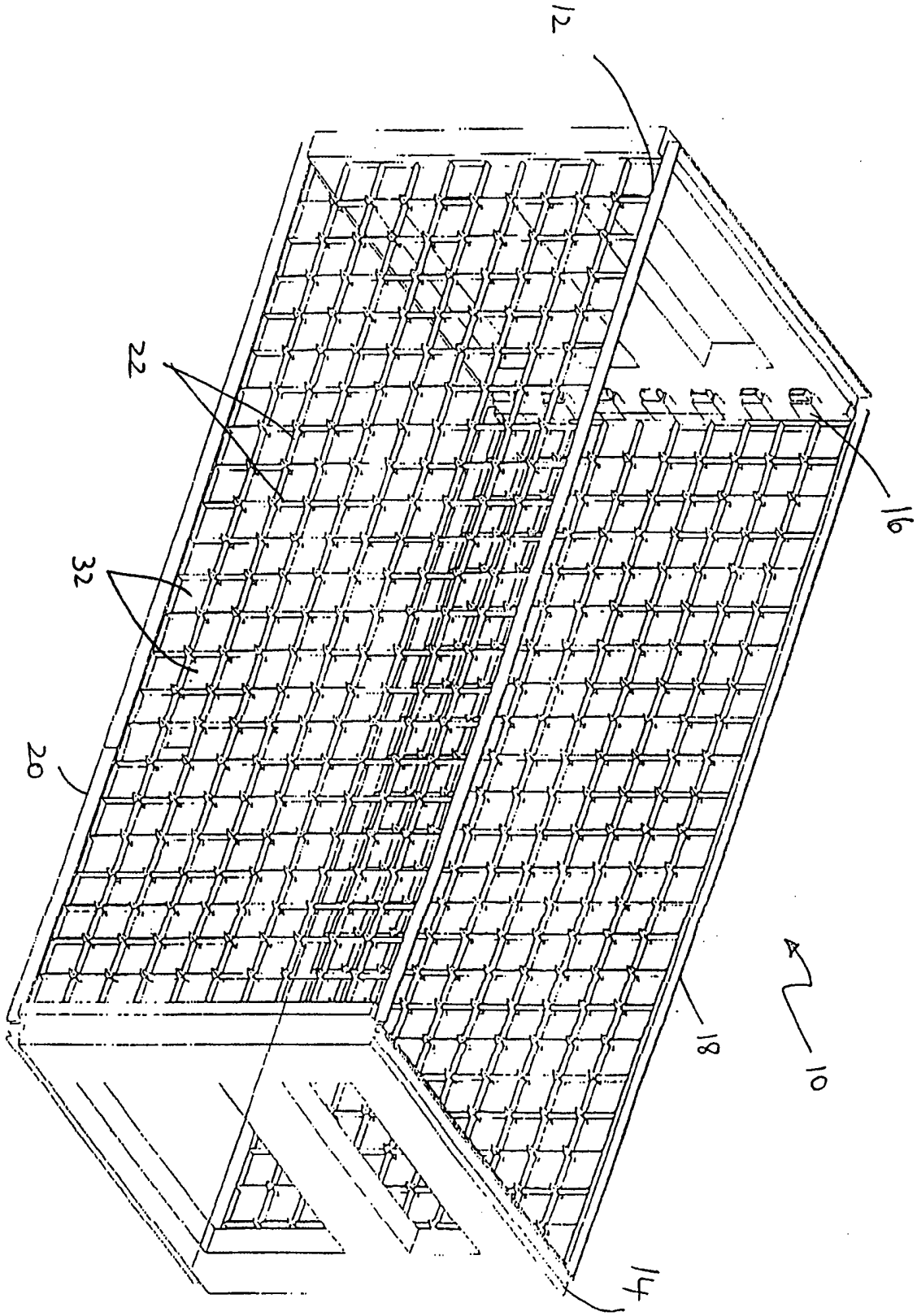


FIGURE 1

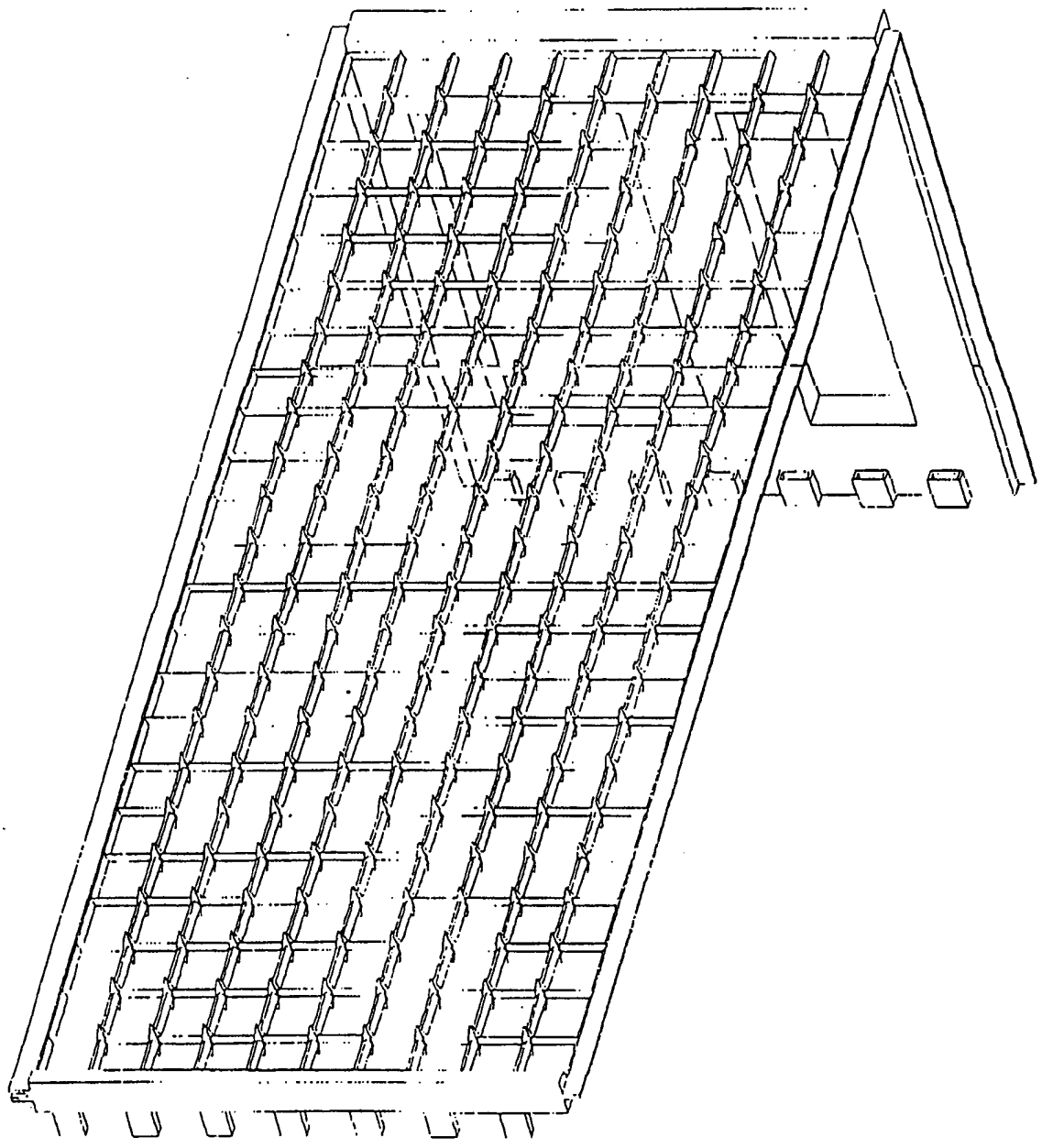


FIGURE 2

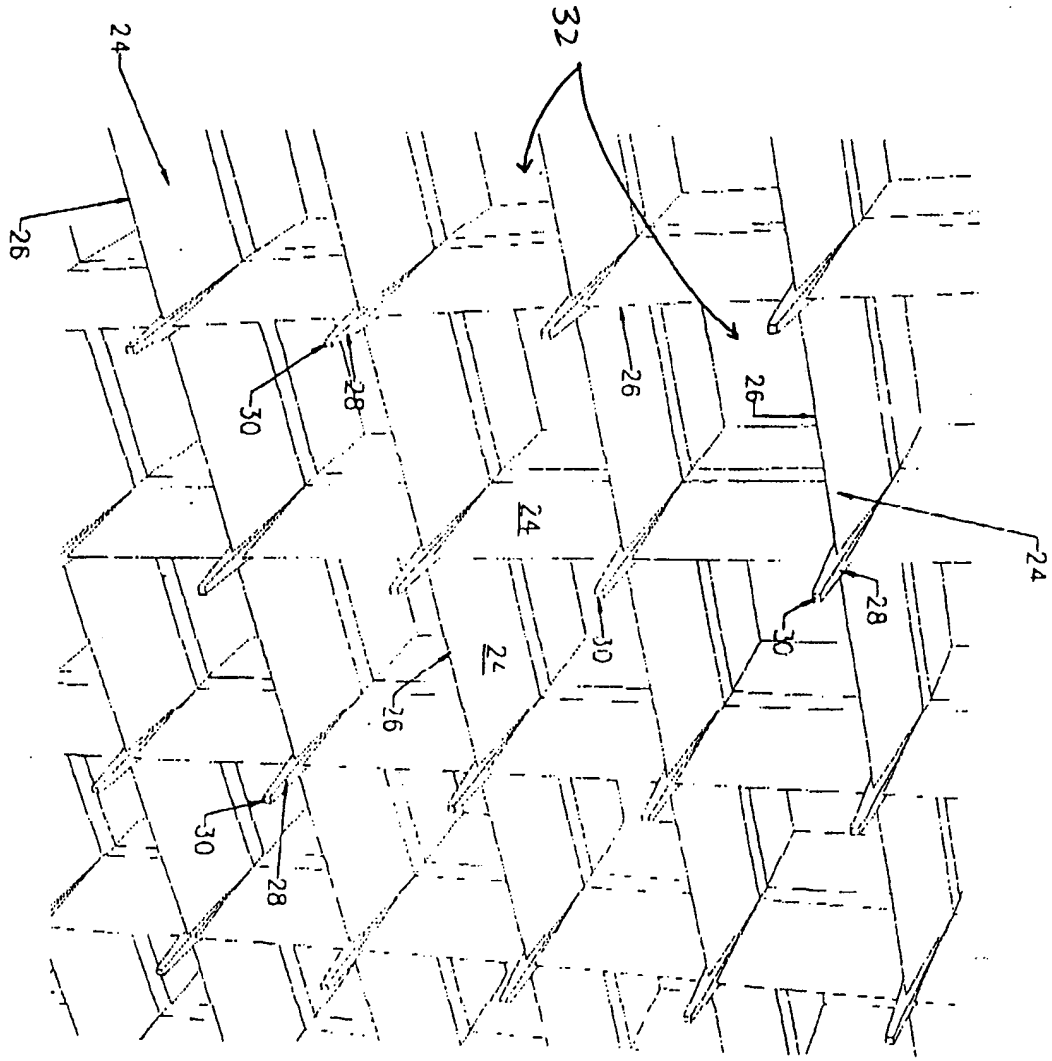


FIGURE 2A

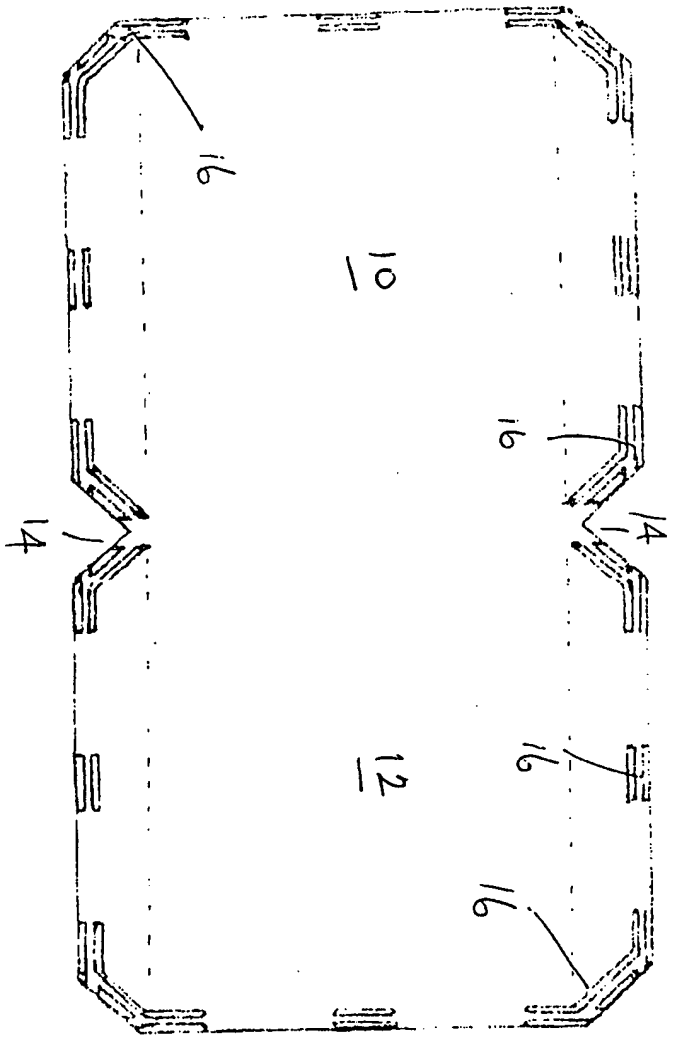
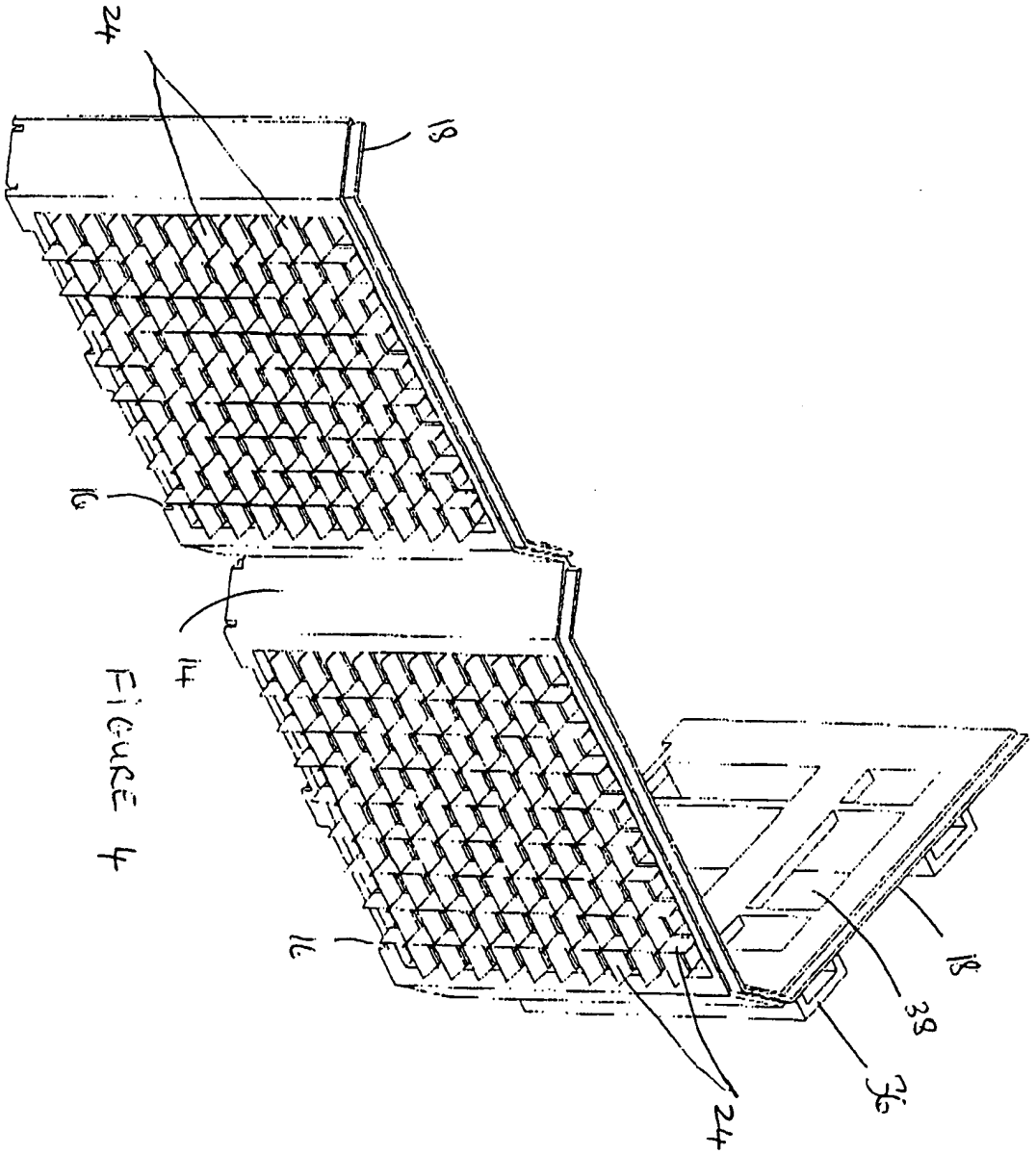


FIGURE 3



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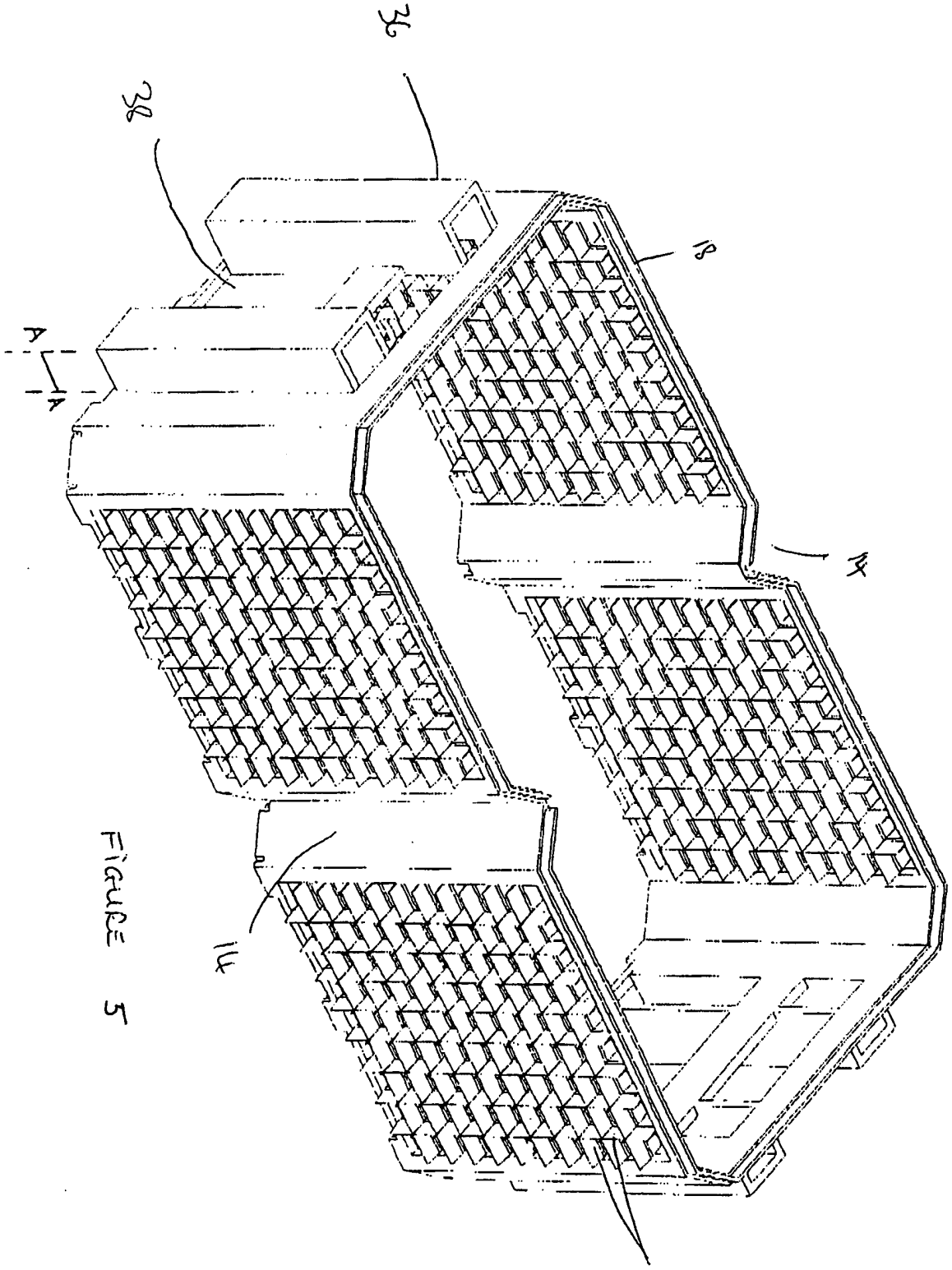
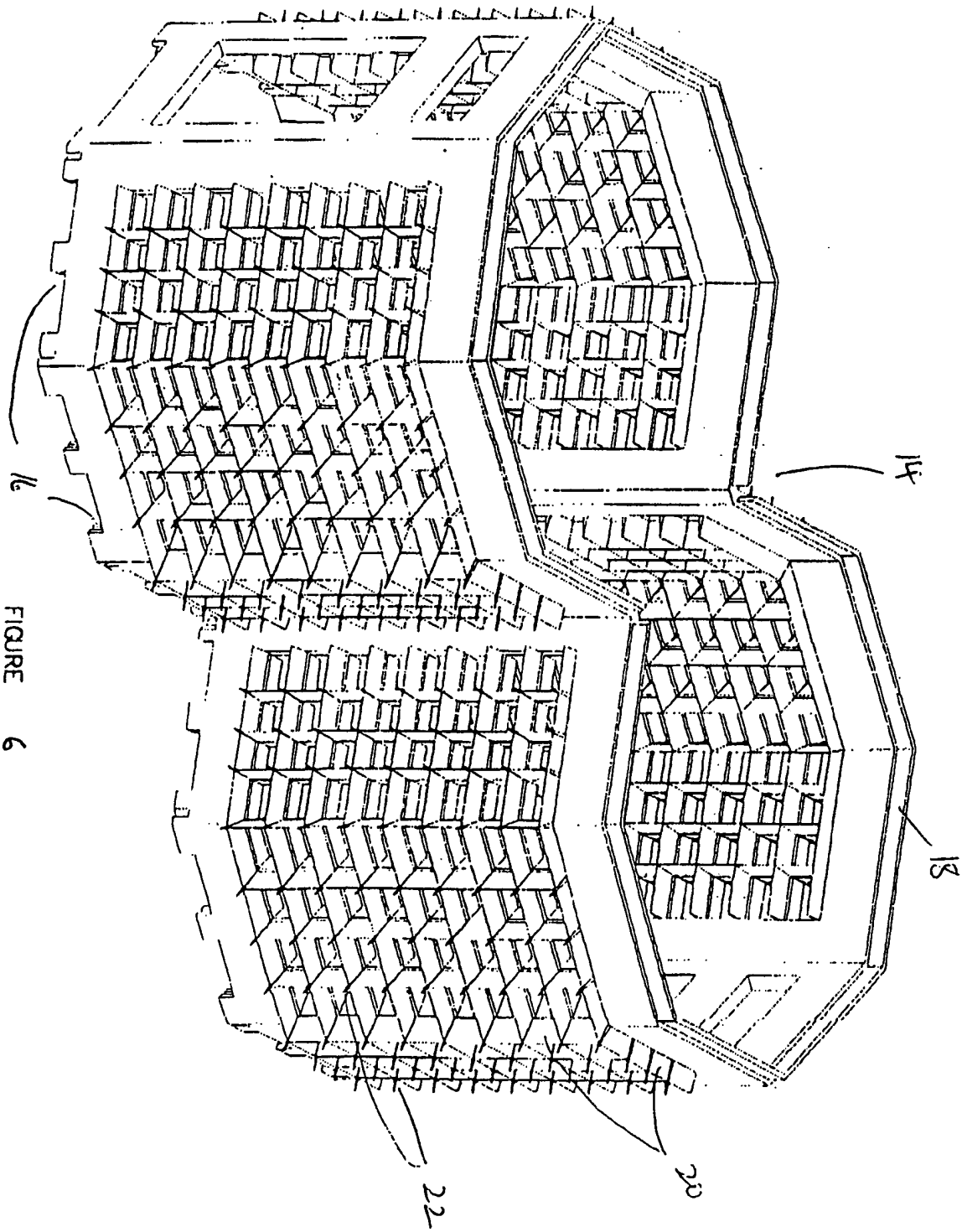


FIGURE 5



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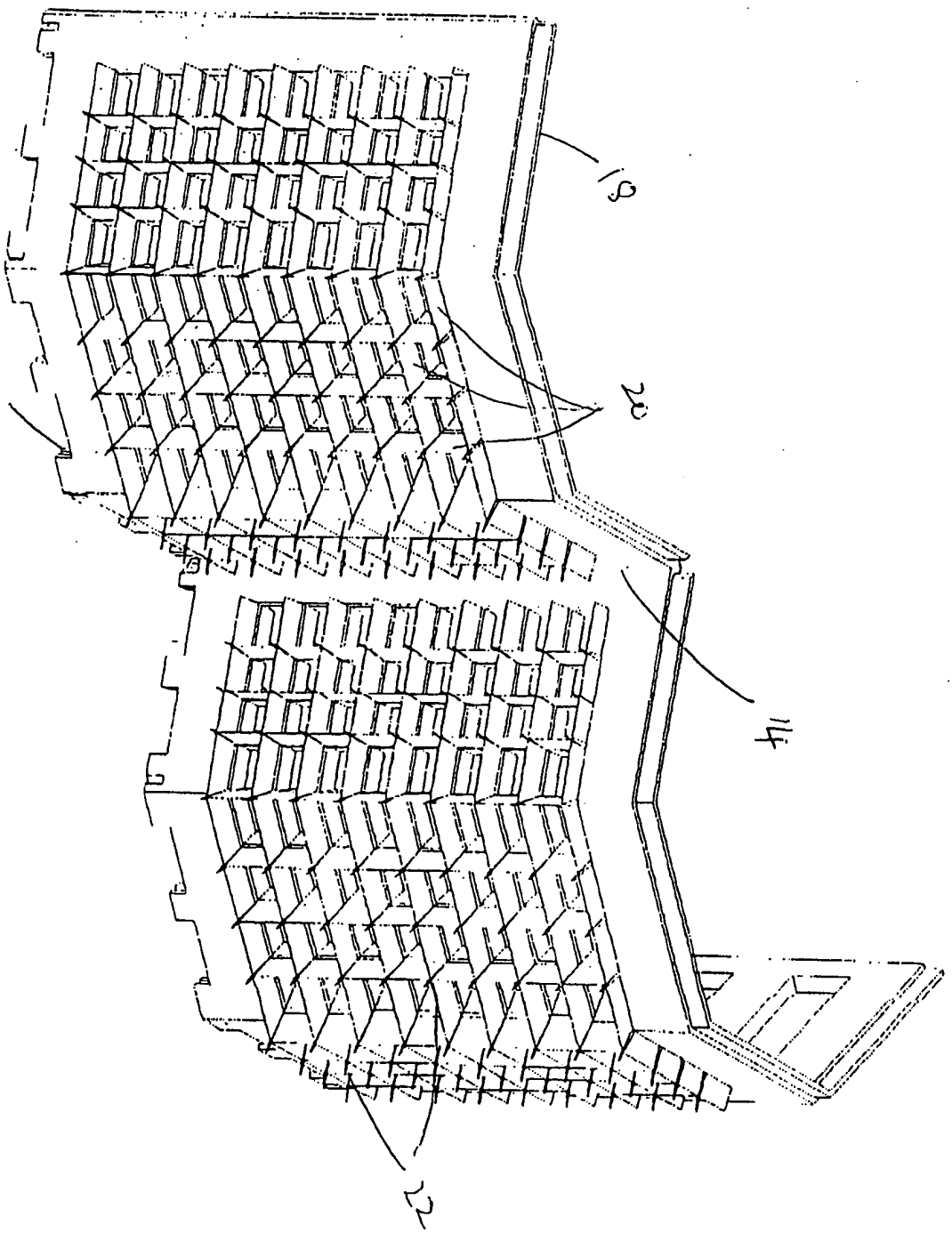

FIGURE 7

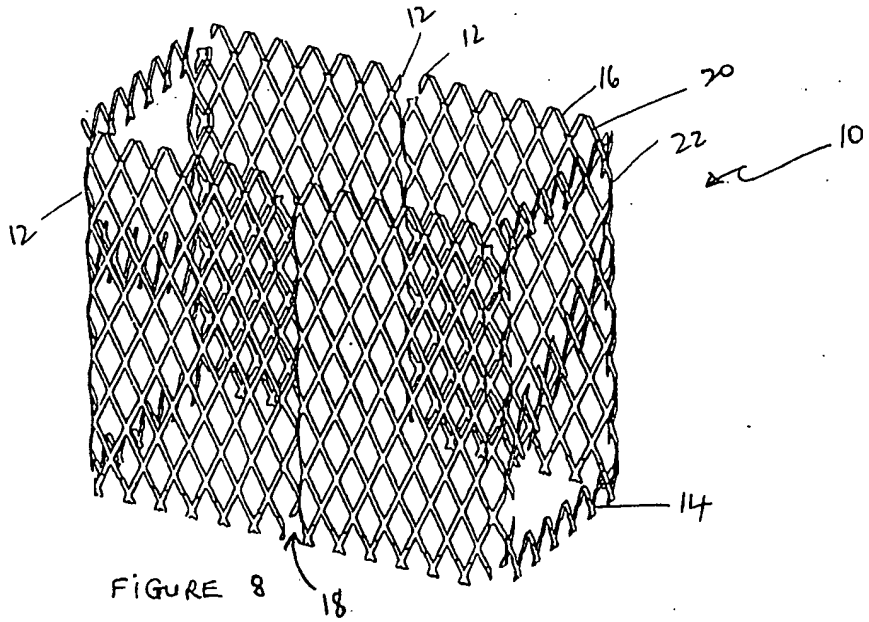

FIGURE 8

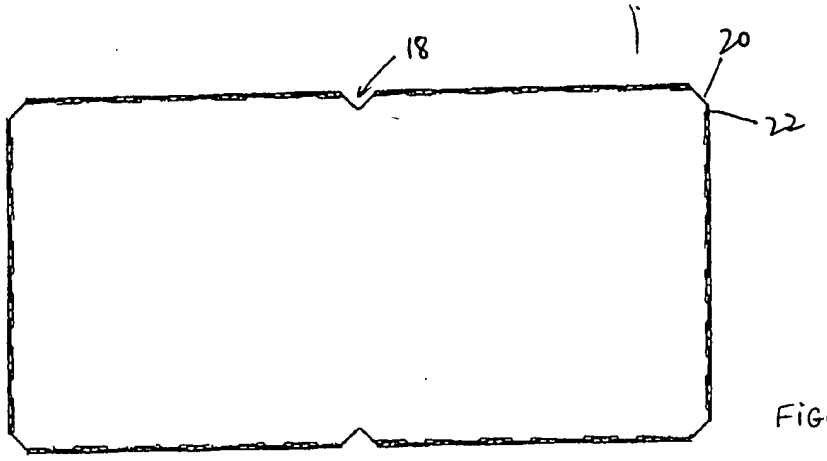

FIGURE 9

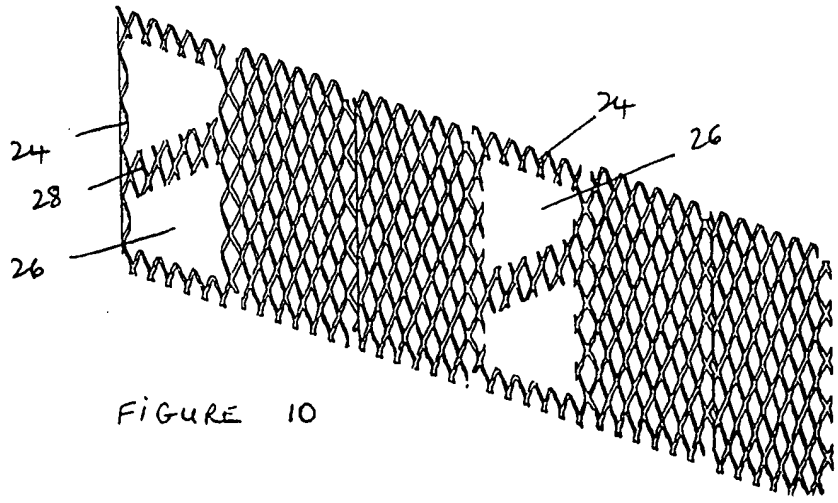

FIGURE 10

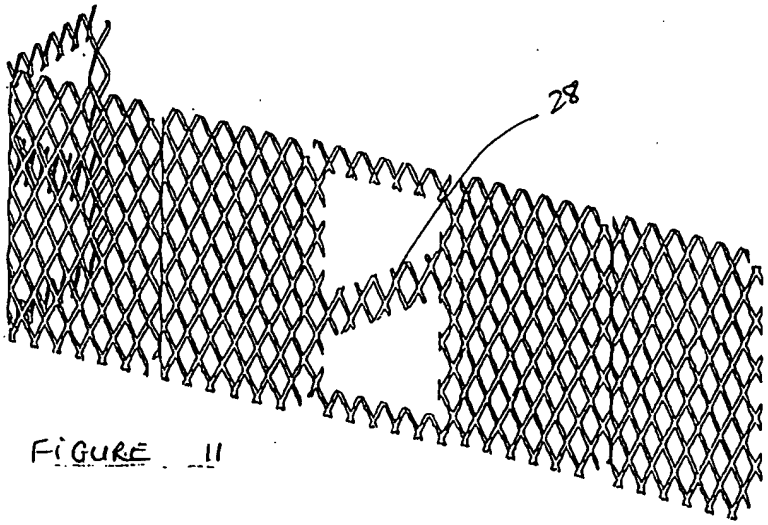

FIGURE 11

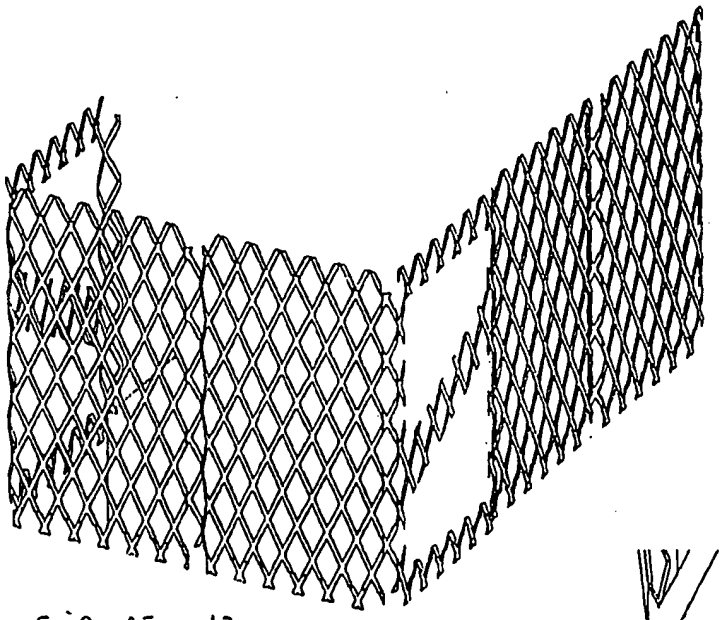

FIGURE 12

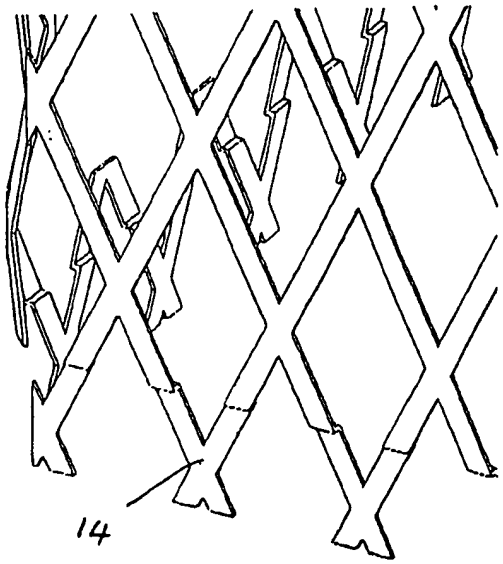

FIGURE 13

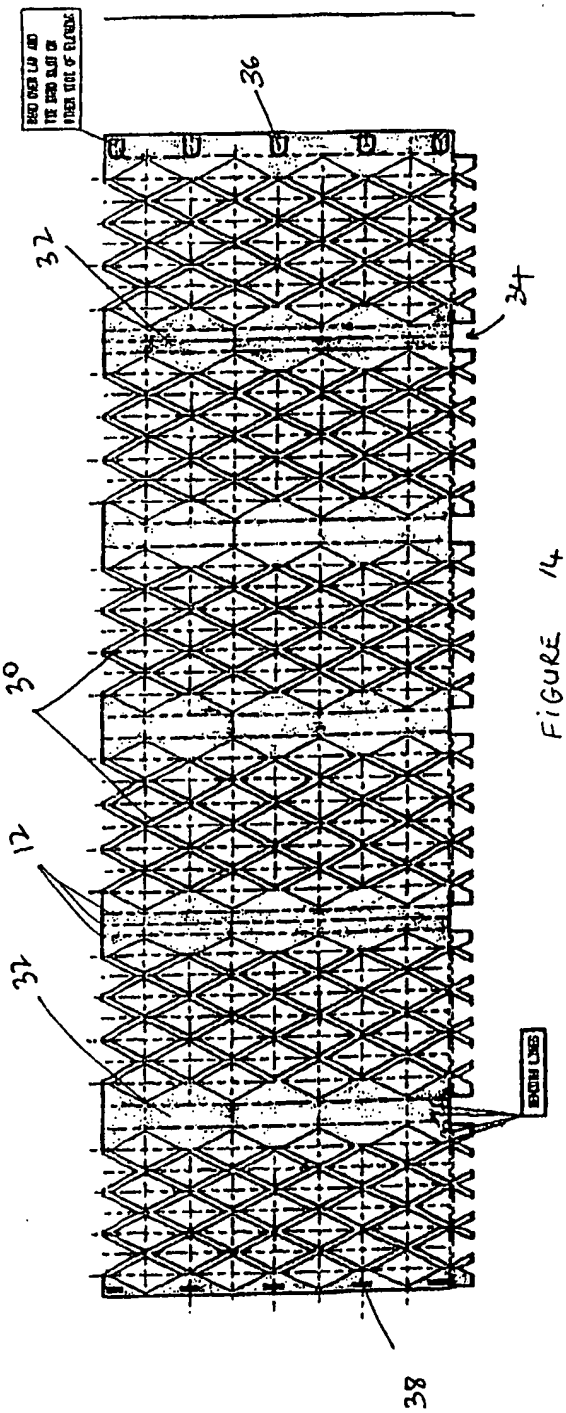

FIGURE 14

FIGURE 15

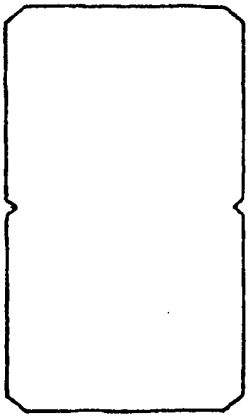

FIGURE 16

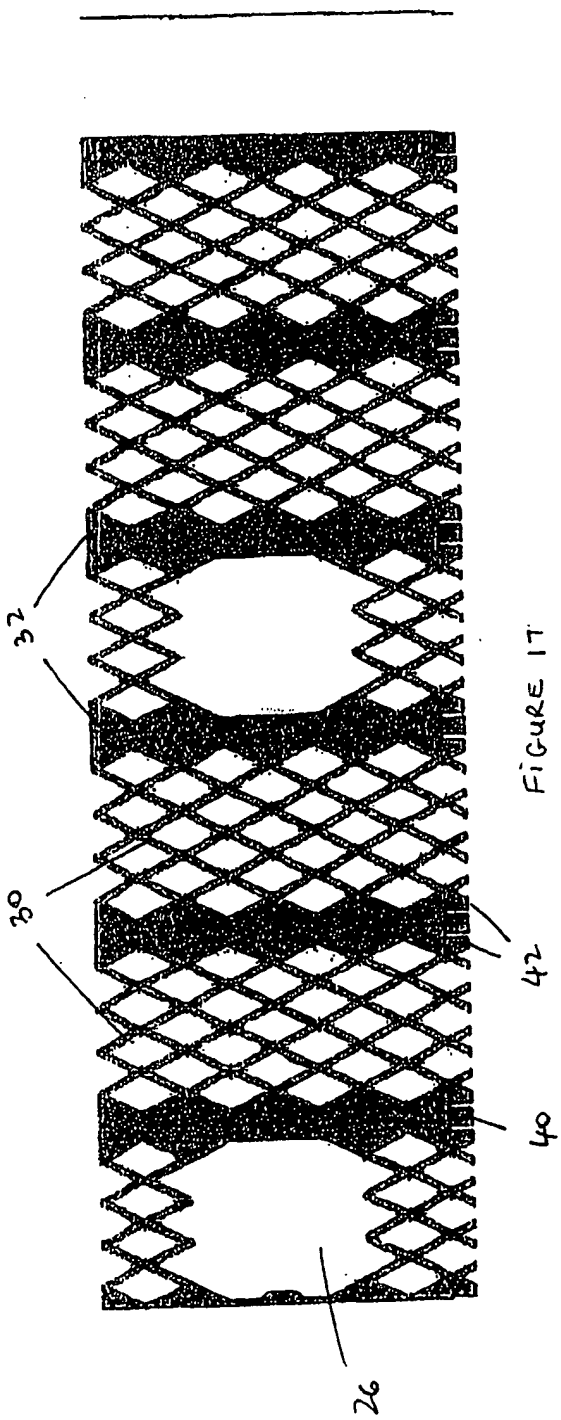

FIGURE 17

FIGURE 18

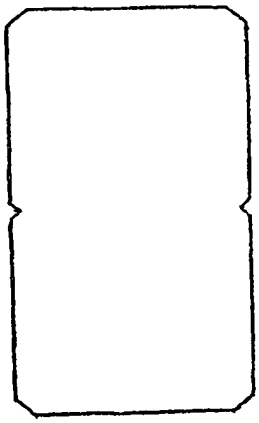

FIGURE 19

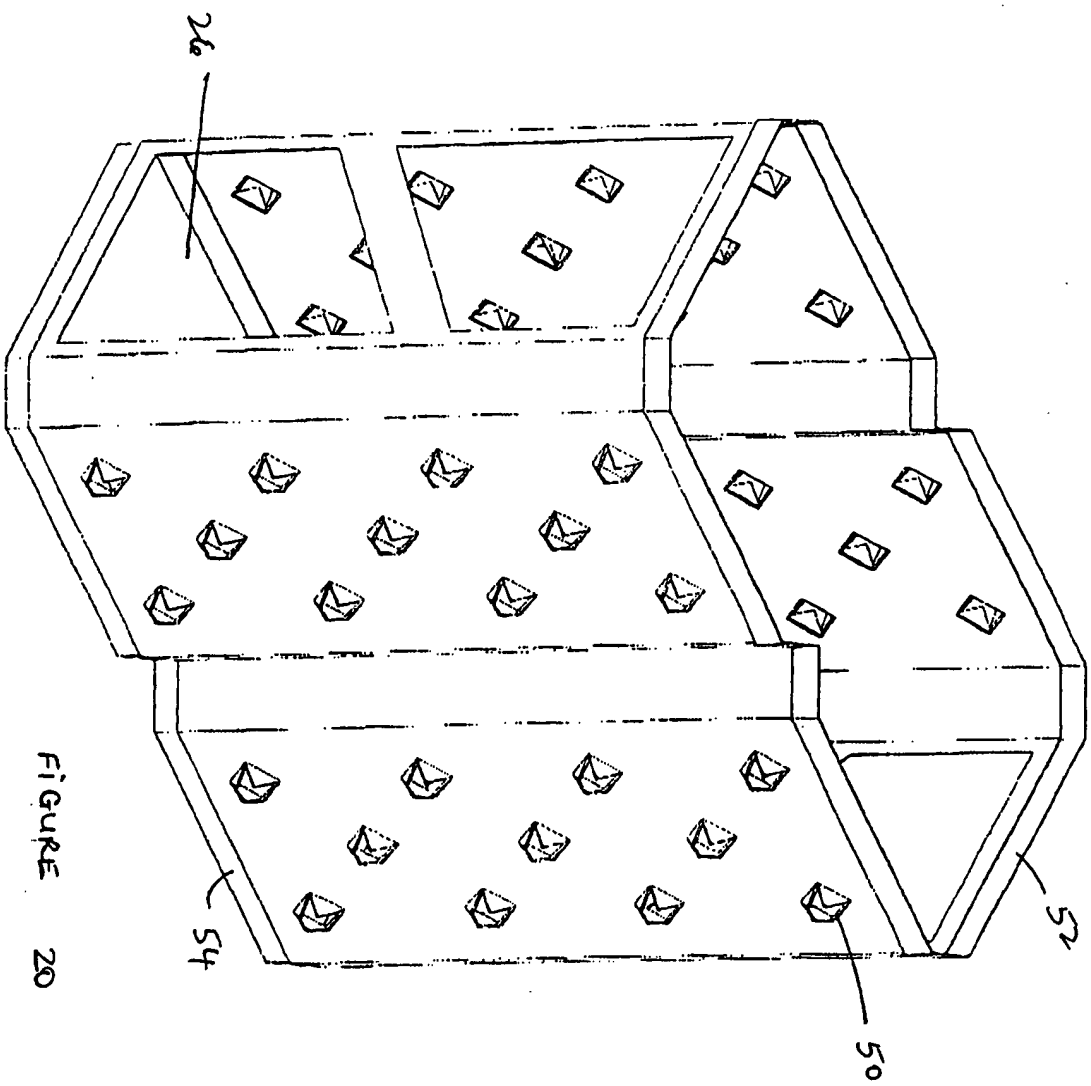

FIGURE 20

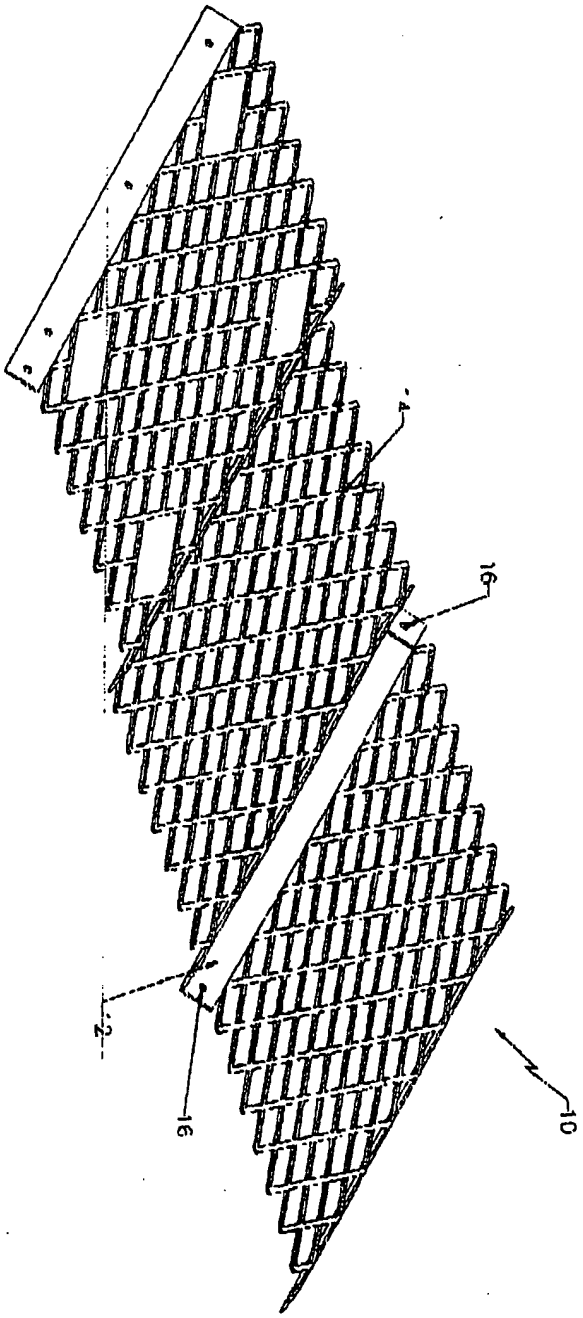

FIGURE 2

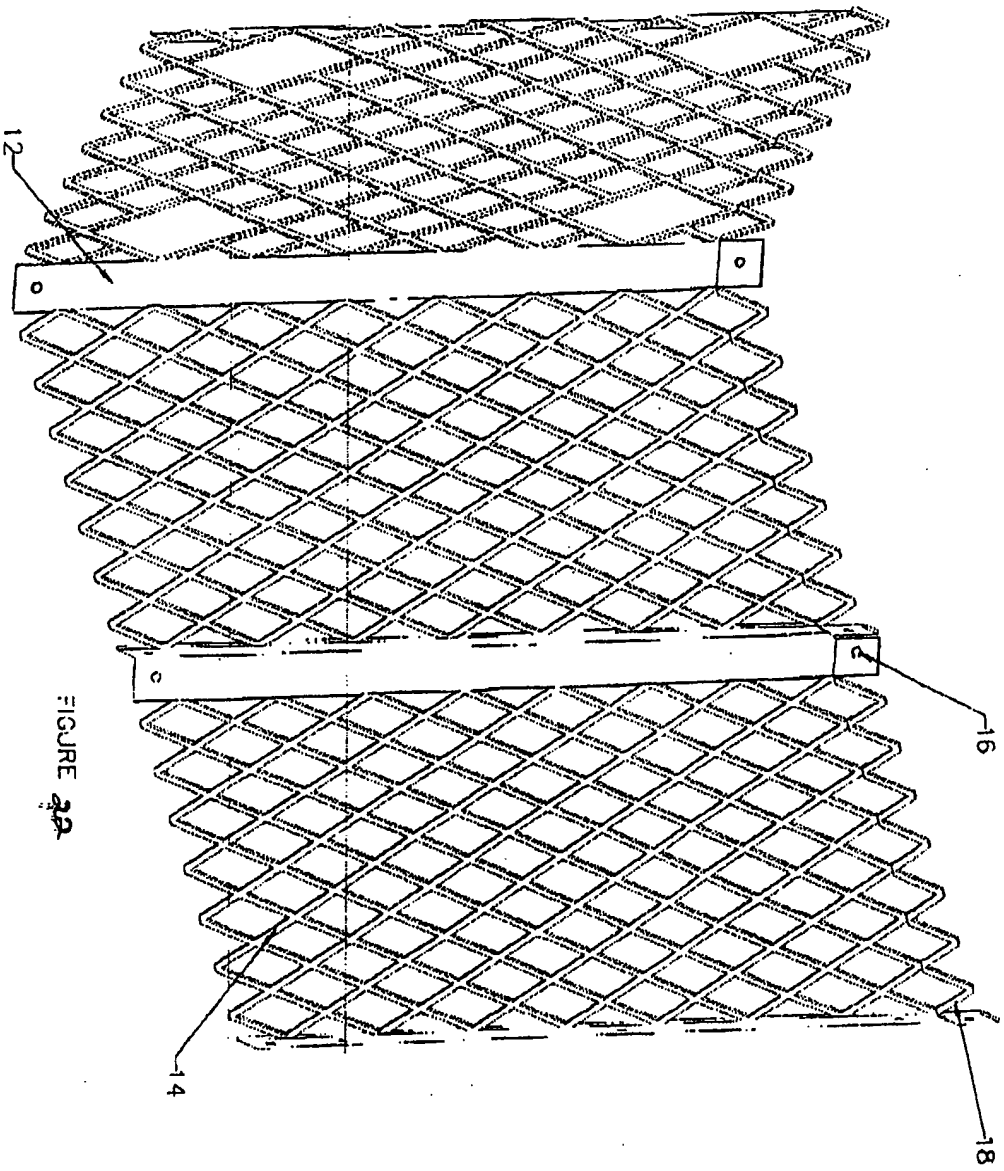

FIGURE 2

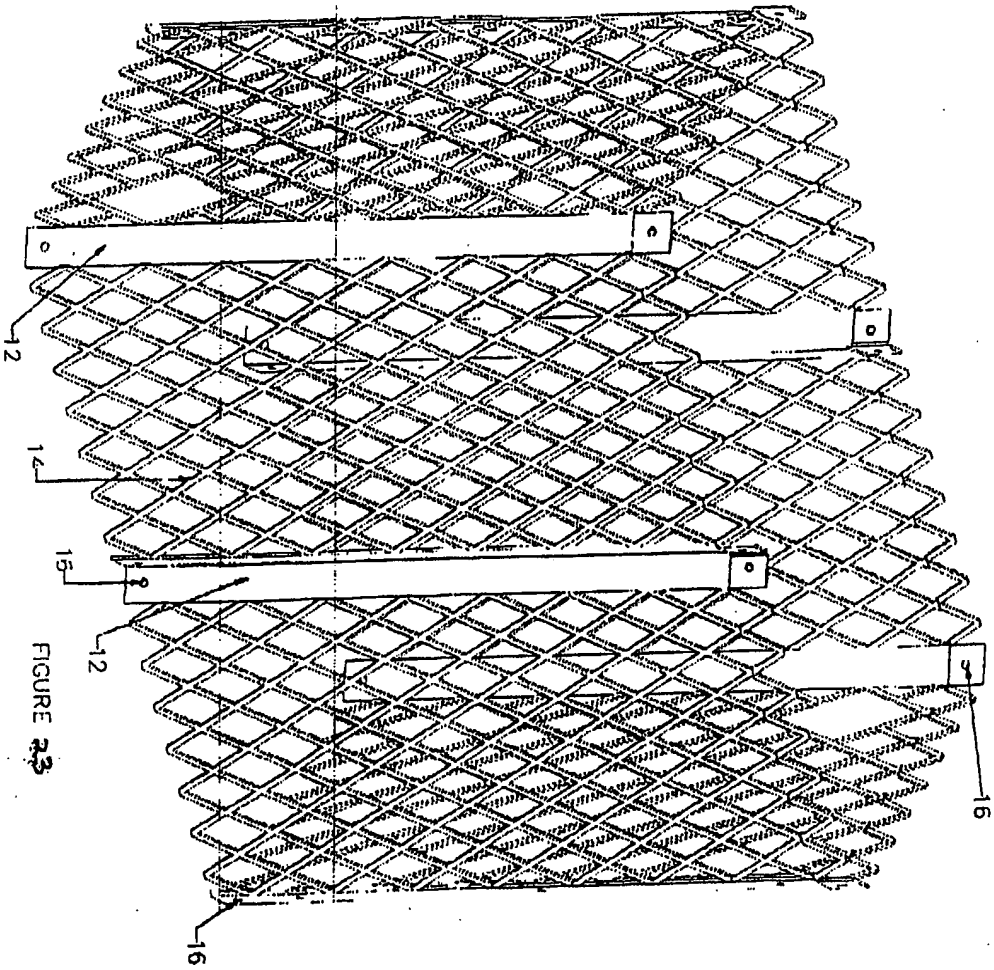

FIGURE 2.3

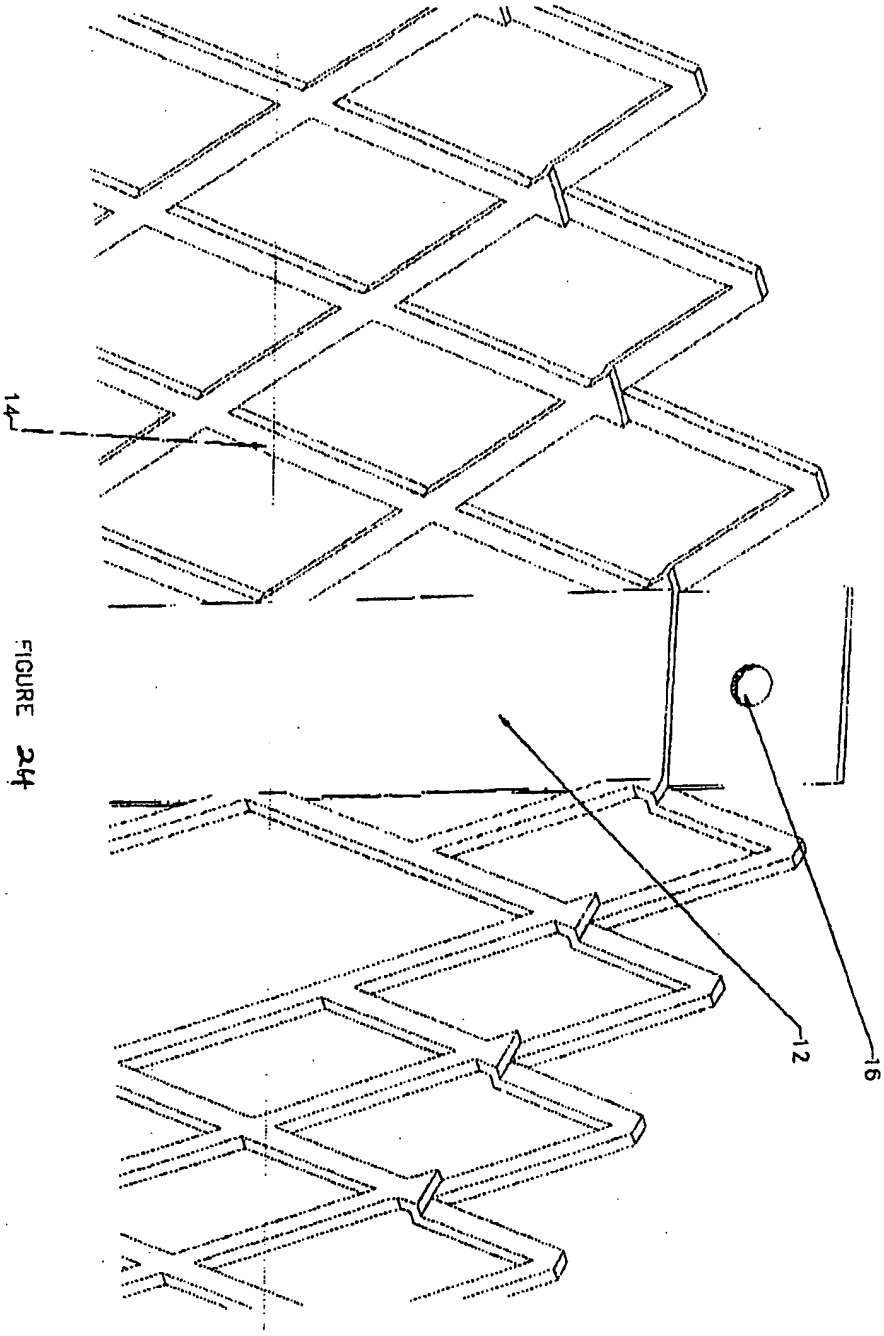

FIGURE 24

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04B2/86

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 295 07 162 U (LU SIN YANG) 6 July 1995 (1995-07-06)	1,4,5,8, 11,21, 22,24, 40,44
A	page 4, line 27 -page 5, line 19; figure 1	2,12
X	DE 196 05 079 C (OBERNOLTE SVEN) 18 September 1997 (1997-09-18) column 3, line 25 -column 4, line 28; figures 2-4	1,4,5, 21,22, 24,40,44
A	US 5 575 119 A (WOLFOWITZ STEVEN A) 19 November 1996 (1996-11-19) the whole document	1,16,20, 44

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 April 2000	18/04/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Vrugt, S

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 29507162 U	06-07-1995	NONE	
DE 19605079 C	18-09-1997	WO 9730239 A	21-08-1997
		EP 0880626 A	02-12-1998
US 5575119 A	19-11-1996	AU 685125 B	15-01-1998
		AU 6859494 A	20-12-1994
		BG 62143 B	31-03-1999
		BG 98798 A	31-10-1996
		BR 9406706 A	27-02-1996
		CA 2164097 A	08-12-1994
		CN 1130410 A	04-09-1996
		HU 72858 A	28-05-1996
		IL 109784 A	08-02-1998
		WO 9428261 A	08-12-1994
		ZW 6994 A	05-10-1994
		ZA 9403676 A	09-02-1995